MAINTAINING CAVE CRICKETS (ORTHOPTERA: RHAPHIDOPHORIDAE) IN THE LABORATORY[1]

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ABSTRACT: Cave crickets of the genera *Euhadenoecus* and *Hadenoecus* (Raphidophoridae) have been maintained in the laboratory for more than 6 months at 15°C with nearly 100% RH. They were fed a mixture of whole egg, oatmeal flakes and a triple sulfa antibiotic, plus mineralized water *ad libitum*. Minimal attention (once a week) reduced disturbance and chances of damage to molting crickets.

The genera *Euhadenoecus* Hubbell and *Hadenoecus* Scudder (Orthoptera: Rhaphidophoridae) are found in or near many caves of karst regions in several states east of the Mississippi River (Hubbel and Norton, 1978). Although two species appear to prefer moist forest litter, the remainder occupy caves. These wingless crickets are among the most numerous large arthropods in caves and are familiar to cave biologists and spelunkers. Taxonomy and general biology have been thoroughly covered by Hubbell and Norton (1978), and the few other reports deal largely with ecology (see Barr 1967, 1968; Barr and Kuehne 1971), population genetics models (Caccone 1985), or physiology (Studier et al., 1986). Lamb and Willey (1975) announced the discovery of parthenogenetic populations in one species of each genus.

Doctoral research on parthenogenesis by RYL necessitated keeping these crickets, in particular *Euhadenoecus insolitus* Hubbell, alive in the laboratory for an extended time. We developed procedures allowing caged populations, which usually "crashed" a few weeks after capture, to be maintained in healthy condition for many months. Much trial and error experience was necessary to find the methods which we present here for the benefit of others who study these interesting insects. Full colonization over several generations was never attempted due to the long developmental time (one to two years) of these crickets (Hubbell and Norton 1978).

Capture and Transport to the Laboratory. - Inside caves the crickets are usually found hanging upside down from the ceiling and overhanging rocks. They were captured by placing a widemouthed quart jar just beneath them. When 10 had been collected, they were transferred to a 40 x 75 cm plastic bag containing 6 crumpled, moist paper towels and a tablespoonful of oatmeal.

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After 50-60 adults and subadults had been put into a bag, it was inflated to prevent crushing the insects, tied and placed in a large styrofoam cooler for transport. When the outside temperature warranted, ice in another bag was kept in the cooler to maintain the crickets at a few degrees below cave temperature. The lower temperature decreased cricket movement, preventing damage to them. Ice bags did not touch cricket bags, however, because cooling too far below cave temperature results in mortality.

Care of Crickets in the Laboratory. - The typical lab cage consisted of a 40-liter styrofoam ice chest with a 6 mm thick plate glass top through which the insects could be viewed. In the bottom of this chest were placed the following: approximately one m^2 of cheesecloth wadded into a flattened ball and soaked with distilled water to maintain nearly 100% RH, a plastic petri dish (15 x 60 mm) with food, and another dish of distilled water containing dolomite pebbles to supply minerals. Twenty adults per cage was the largest density at which no appreciable limb loss or mortality occurred. Cages were placed in a large circulating air climate chamber (Percival, Model I 35 LVL) which was kept dark at a constant 15°C. Food and water in the cages were changed and the cheese cloth doused with water once every third day for the first two weeks and once per week thereafter to minimize the chance of disturbing molting crickets. At this time the open cage was briefly fanned manually to freshen the air. Only new cages were used for newly captured crickets, and were not cleaned nor reused.

Food was a mixture of whole raw egg and oatmeal flakes, 2:1 by weight. To the egg we added three sulfa compounds (Sigma Chemical Co.: sulfathiazole, sulfapyridine, sulfamethazine, 6:4:3 by weight), at 1.6% the total weight of the mixture. Sulfa and egg were mixed thoroughly for ten minutes and then the oatmeal was mixed in with a tongue blade to make a moist doughy mass. Food was prepared fresh about once a month and kept covered in a refrigerator. Triple-sulfa was used to prevent cage deaths from endemic gregarine infections and possible cross-infection by *Malamoeba locustae* from grasshoppers reared in the same room. The sulfa compounds do not kill the parasites but do prevent their reproduction and spore formation (Henry, 1968). Lower (e.g., 1.0%) or higher (3.0%) percentages showed more cricket mortality, the higher percentage perhaps due to sulfa toxicity (Henry, 1968). With the triple-sulfa additive the caged crickets lived at least 6 months; without it the cage populations would crash about 5 to 6 weeks after they were brought in from the field.

At times, crickets were observed to be debilitated despite the sulfa treatment. For experimentation it was necessary to distinguish sick crickets from healthy ones; the following criteria were developed:

A healthy cricket's crop was full or 3/4 full of food, visible through the

dorsal thorax and abdomen. The insect was alert to escape during attempts to capture it. At postmortem, the body hemolymph was plentiful and the gonads were plump and of appropriate size for its age.

On the other hand, a sick cricket had a gas filled crop without other contents. The escape reaction was minimal and the cricket walked stiffly as if "arithritic." At postmortem, the body cavity was dry, gonads were small, dry and/or discolored.

Although eggs were laid readily by mated controls in moist sand about 1 or 2 cm deep in battery jars, we did not keep sand in the cages nor did we attempt to hatch the eggs. Instead eggs were allowed to accumulate in the female for 5 weeks. The crickets then were sacrificed and the mature unfertilized or parthenogenetic eggs were allowed to develop to blastoderm stage in shallow tapwater at culture temperature. Females can live for many months without laying eggs, resorbing them eventually. Full details can be found in Lamb (1985).

The above methods would probably work equally well for cave crickets of the genus *Ceuthophilus* and other camel crickets that are dependent on high humidity.

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